

Practice and Problem Solving

Extra Practice is on page 556.

Example 1

Use a table of values to graph each equation. State the domain and range.

22. $y = x^2 + 4x + 6$

23. $y = 2x^2 + 4x + 7$

24. $y = 2x^2 - 8x - 5$

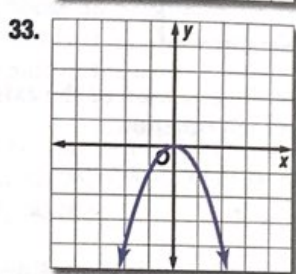
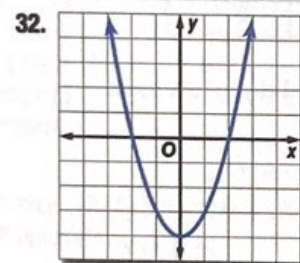
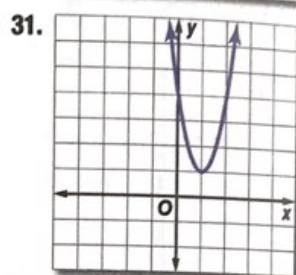
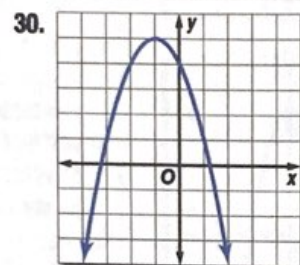
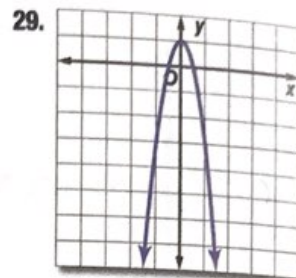
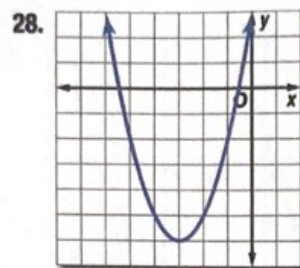
25. $y = 3x^2 + 12x + 5$

26. $y = 3x^2 - 6x - 2$

27. $y = x^2 - 2x - 1$

Example 2

Find the vertex, the equation of the axis of symmetry, and the y -intercept of each graph.



28. vertex $(-1, -2)$,
axis of symmetry
 $x = -1$,
 y -intercept -4
29. vertex $(0, 3)$,
axis of symmetry
 $x = 0$,
 y -intercept 3
30. vertex $(1, 5)$,
axis of symmetry
 $x = 1$,
 y -intercept 1
31. vertex $(1, 1)$,
axis of symmetry
 $x = 1$,
 y -intercept 2
32. vertex $(0, -4)$,
axis of symmetry
 $x = 0$,
 y -intercept -4
33. vertex $(0, 0)$,
axis of symmetry
 $x = 0$,
 y -intercept 0

Example 3

Find the vertex, the equation of the axis of symmetry, and the y -intercept of each function. 34–42. See margin.

34. $y = x^2 + 8x + 10$

35. $y = 2x^2 + 12x + 10$

36. $y = -3x^2 - 6x + 7$

37. $y = -x^2 - 6x - 5$

38. $y = 5x^2 + 20x + 10$

39. $y = 7x^2 - 28x + 14$

40. $y = 2x^2 - 12x + 6$

41. $y = -3x^2 + 6x - 18$

42. $y = -x^2 + 10x - 13$

Example 4

Consider each function. 43–51. See margin.

a. Determine whether the function has a *maximum* or *minimum* value.

b. State the maximum or minimum value.

c. What are the domain and range of the function?

43. $y = -2x^2 - 8x + 1$

44. $y = x^2 + 4x - 5$

45. $y = 3x^2 + 18x - 21$

46. $y = -2x^2 - 16x + 18$

47. $y = -x^2 - 14x - 16$

48. $y = 4x^2 + 40x + 44$

49. $y = -x^2 - 6x - 5$

50. $y = 2x^2 + 4x + 6$

51. $y = -3x^2 - 12x - 9$

Example 5

Graph each function. 52–57. See Ch. 9 Answer Appendix.

52. $y = -3x^2 + 6x - 4$

53. $y = -2x^2 - 4x - 3$

54. $y = -2x^2 - 8x + 2$

55. $y = x^2 + 6x - 6$

56. $y = x^2 - 2x + 2$

57. $y = 3x^2 - 12x + 5$



28. vertex $(-3, -6)$,
axis of symmetry
 $x = -3$,
 y -intercept 3

29. vertex $(0, 1)$, axis
of symmetry $x = 0$,
 y -intercept 1

30. vertex $(-1, 5)$, axis
of symmetry $x =$
 -1 , y -intercept 4

31. vertex $(1, 1)$, axis
of symmetry $x = 1$,
 y -intercept 4

32. vertex $(0, -4)$, axis
of symmetry $x = 0$,
 y -intercept -4

33. vertex $(0, 0)$, axis
of symmetry $x = 0$,
 y -intercept 0

Additional Answers

34. vertex $(-4, -6)$, axis of symmetry $x = -4$, y -intercept 10
35. vertex $(-3, -8)$, axis of symmetry $x = -3$, y -intercept 10
36. vertex $(-1, 10)$, axis of symmetry $x = -1$, y -intercept 7
37. vertex $(-3, 4)$, axis of symmetry $x = -3$, y -intercept -5
38. vertex $(-2, -10)$, axis of symmetry $x = -2$, y -intercept 10
39. vertex $(2, -14)$, axis of symmetry $x = 2$, y -intercept 14
40. vertex $(3, -12)$, axis of symmetry $x = 3$, y -intercept 6
41. vertex $(1, -15)$, axis of symmetry $x = 1$, y -intercept -18
42. vertex $(5, 12)$, axis of symmetry $x = 5$, y -intercept -13
- 43a. maximum 43b. 9
- 43c. $D = \{\text{all real numbers}\}$,
 $R = \{y \mid y \leq 9\}$
- 44a. minimum 44b. -9
- 44c. $D = \{\text{all real numbers}\}$,
 $R = \{y \mid y \geq -9\}$
- 45a. minimum 45b. -48
- 45c. $D = \{\text{all real numbers}\}$,
 $R = \{y \mid y \geq -48\}$
- 46a. maximum 46b. 50
- 46c. $D = \{\text{all real numbers}\}$,
 $R = \{y \mid y \leq 50\}$
- 47a. maximum 47b. 33
- 47c. $D = \{\text{all real numbers}\}$,
 $R = \{y \mid y \leq 33\}$
- 48a. minimum 48b. -56
- 48c. $D = \{\text{all real numbers}\}$,
 $R = \{y \mid y \geq -56\}$
- 49a. maximum 49b. 4
- 49c. $D = \{\text{all real numbers}\}$,
 $R = \{y \mid y \leq 4\}$
- 50a. minimum 50b. 4
- 50c. $D = \{\text{all real numbers}\}$,
 $R = \{y \mid y \geq 4\}$
- 51a. maximum 51b. 3
- 51c. $D = \{\text{all real numbers}\}$,
 $R = \{y \mid y \leq 3\}$

Check Your Understanding

= Step-by-Step Solutions begin on page R13.

Examples 1–3 Solve each equation by graphing. **1–4. See Ch. 9 Answer Appendix for graphs.**

1. $x^2 + 3x - 10 = 0$ **2, -5**

2. $2x^2 - 8x = 0$ **0, 4**

3. $x^2 + 4x = -4$ **-2**

4. $x^2 + 12 = -8x$ **-6, -2**

Example 4 Solve each equation by graphing. If integral roots cannot be found, estimate the roots to the nearest tenth. **5–8. See Ch. 9 Answer Appendix for graphs.**

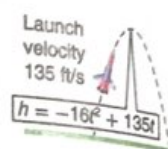
5. $-x^2 - 5x + 1 = 0$ **-5.2, 0.2**

6. $-9 = x^2$ **no solutions**

7. $x^2 = 25$ **5, -5**

8. $x^2 - 8x = -9$ **6.6, 1.4**

Example 5 **9. SCIENCE FAIR** Ricky built a model rocket. Its flight can be modeled by the equation shown, where h is the height of the rocket in feet after t seconds. About how long was Ricky's rocket in the air? **about 8.4 seconds**



Practice and Problem Solving

Extra Practice is on p.

Examples 1–3 Solve each equation by graphing. **10–21. See Ch. 9 Answer Appendix for graphs.**

10. $x^2 + 7x + 14 = 0$ **∅**

11 $x^2 + 2x - 24 = 0$ **4, -6**

12. $x^2 - 16x + 64 = 0$ **8**

13. $x^2 - 5x + 12 = 0$ **∅**

14. $x^2 + 14x = -49$ **-7**

15. $x^2 = 2x - 1$ **1**

16. $x^2 - 10x = -16$ **2, 8**

17. $-2x^2 - 8x = 13$ **∅**

18. $2x^2 - 16x = -30$ **3, 5**

19. $2x^2 = -24x - 72$ **-6**

20. $-3x^2 + 2x = 15$ **∅**

21. $x^2 = -2x + 80$ **8, -10**

Example 4 Solve each equation by graphing. If integral roots cannot be found, estimate the roots to the nearest tenth. **22–27. See Ch. 9 Answer Appendix for graphs.**

22. $x^2 + 2x - 9 = 0$

23. $x^2 - 4x = 20$ **6.9, -2.9**

24. $x^2 + 3x = 18$ **3, -6**

25. $2x^2 - 9x = -8$ **2.2, -4.2**

26. $3x^2 = -2x + 7$ **1.2, -1.9**

27. $5x = 25 - x^2$ **3.1, -8.1**

Example 5 **28. SOFTBALL** The equation $h = -16t^2 + 47t + 3$ models the height h , in feet, of a ball that Sofia hits after t seconds. How long is the ball in the air? **3 seconds**

B **29. RIDES** The Terror Tower launches riders straight up and returns straight down. The equation $h = -16t^2 + 122t$ models the height h , in feet, of the riders from their starting position after t seconds. How long is it until the riders return to the bottom? **about 7.6 seconds**

Use factoring to determine how many times the graph of each function intersects the x -axis. Identify each zero.

30. $y = x^2 - 8x + 16$ **1; 4**

31. $y = x^2 + 4x + 4$ **1; -2**

32. $y = x^2 + 2x - 24$ **2; -6, 4**

33. $y = x^2 + 12x + 32$ **2; -4, -8**

34. NUMBER THEORY Use a quadratic equation to find two numbers that have a sum of 9 and a product of 20. **4, 5**

35. NUMBER THEORY Use a quadratic equation to find two numbers that have a sum of 1 and a product of -12. **-3, 4**

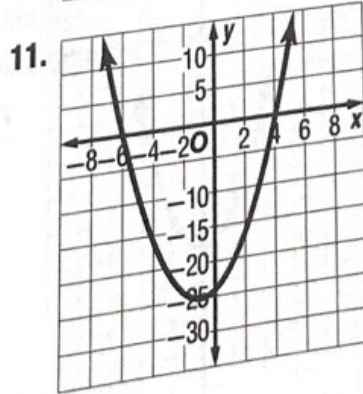
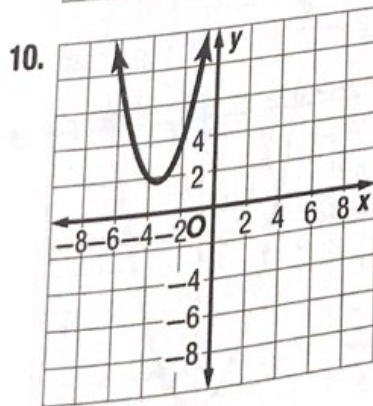
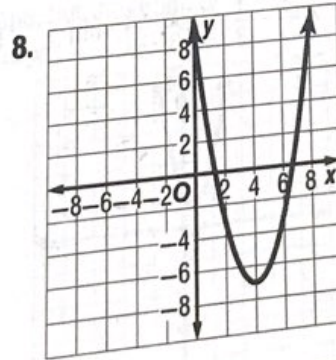
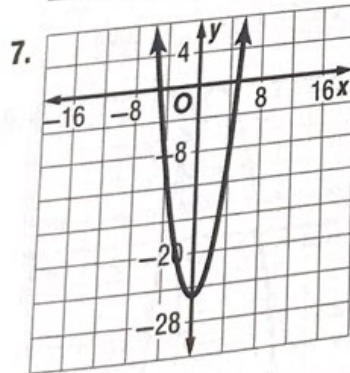
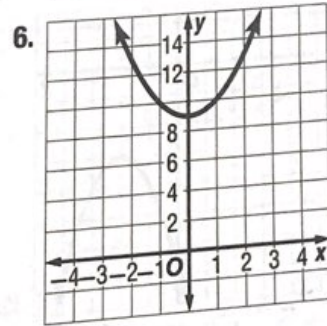
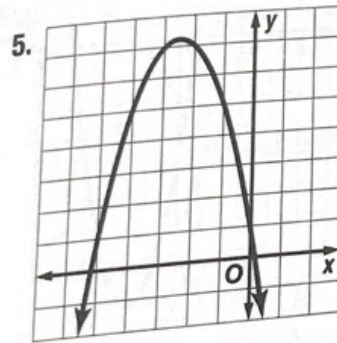
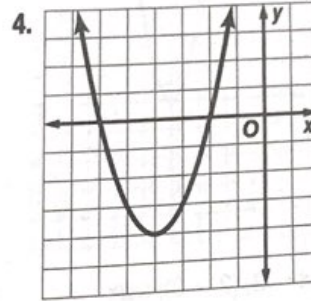
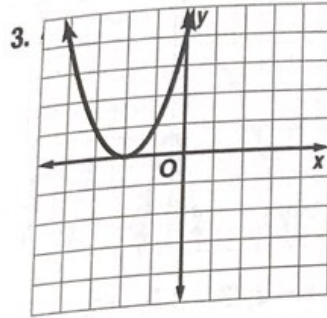
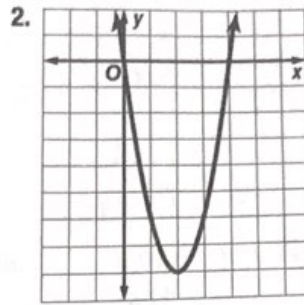
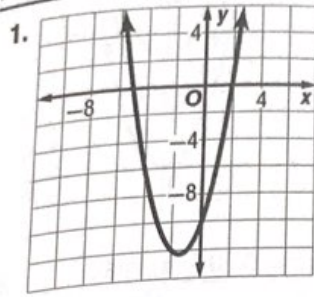
36. CCSS MODELING The height of a golf ball in the air can be modeled by the equation $h = -16t^2 + 76t$, where h is the height in feet of the ball after t seconds.

a. How long was the ball in the air? **about 4.5 seconds**

b. What is the ball's maximum height? **about 81 ft**

c. When will the ball reach its maximum height? **about 2.2 seconds**

Lesson 9-2



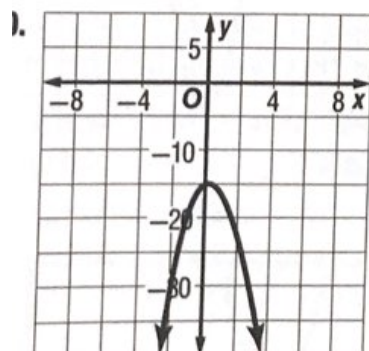
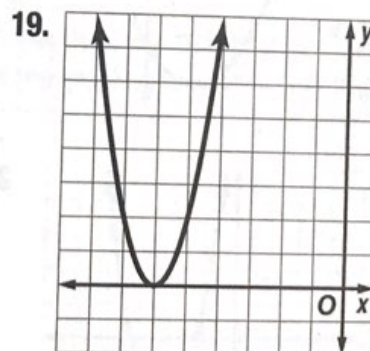
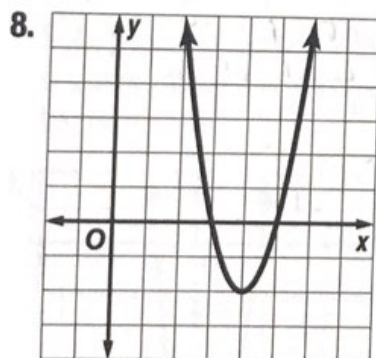
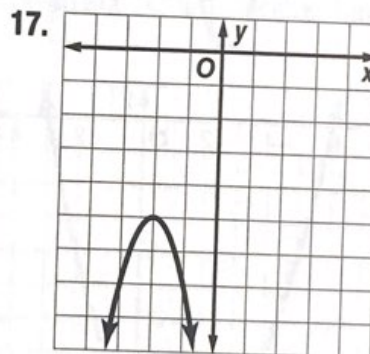
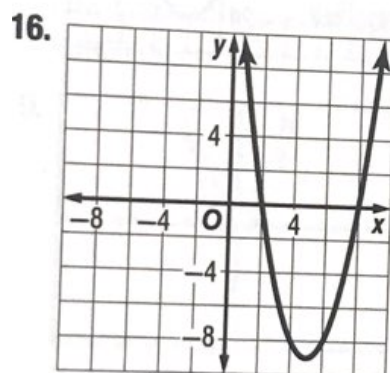
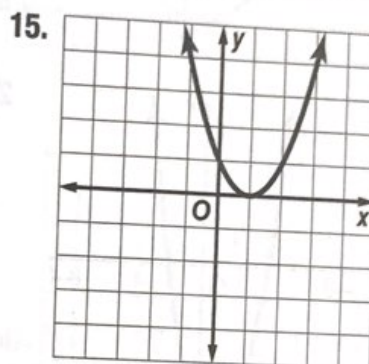
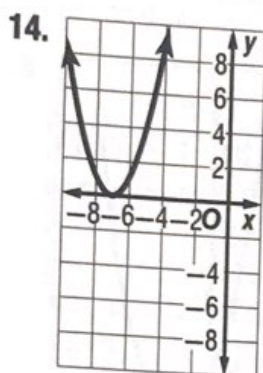
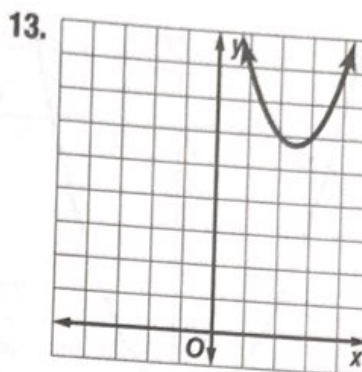
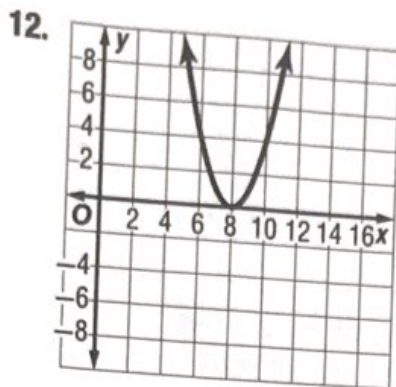
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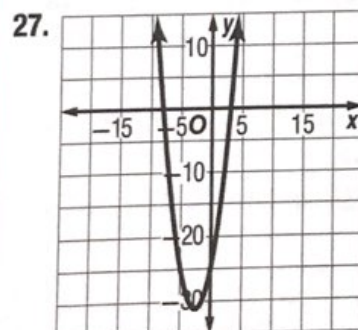
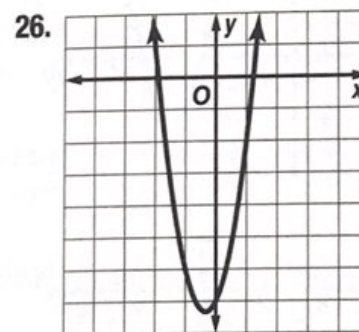
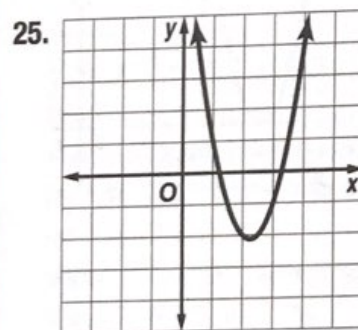
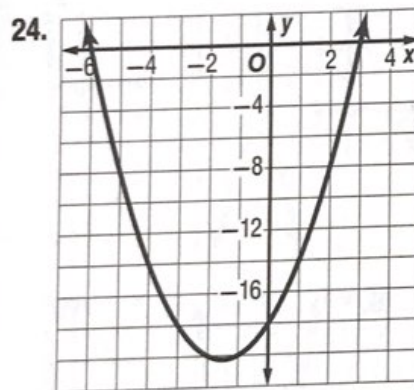
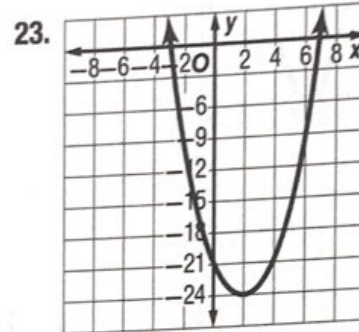
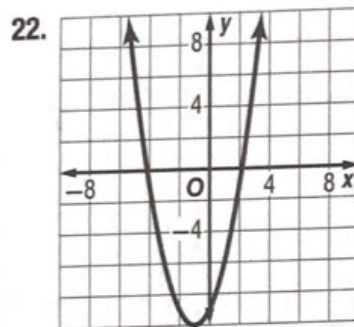
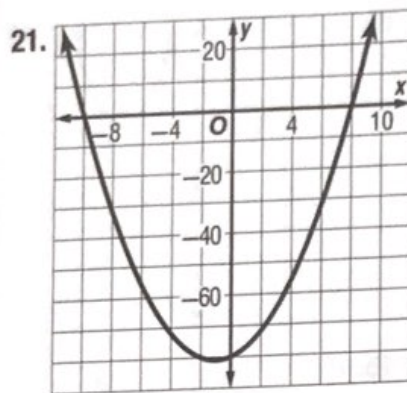
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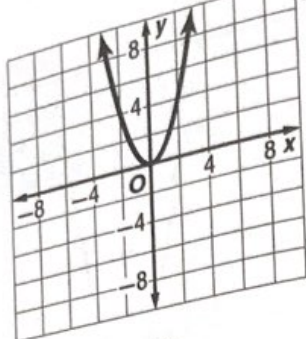
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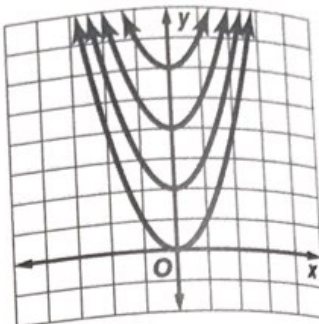
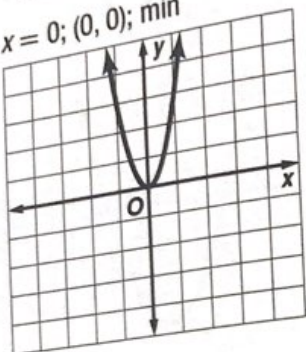
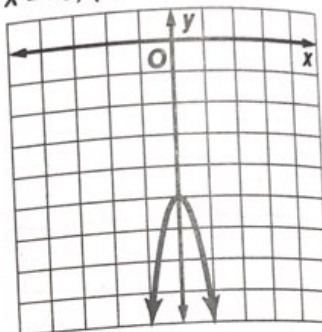
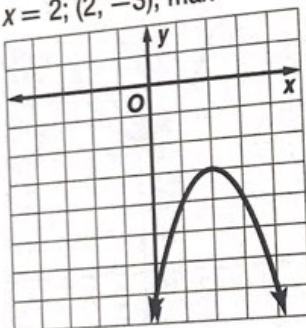
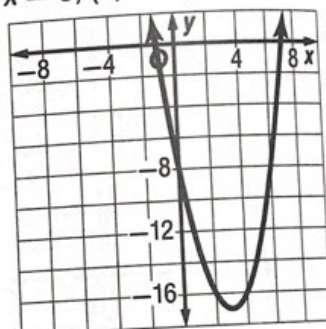
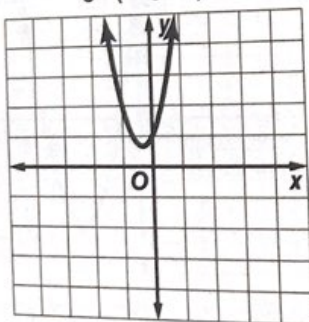
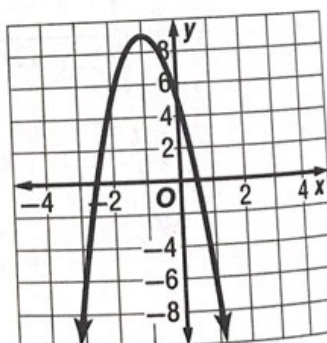




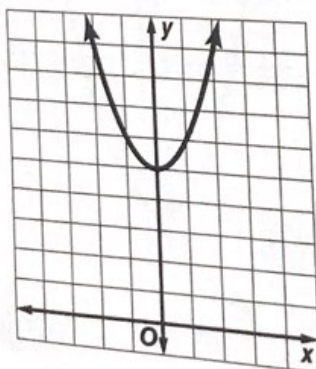
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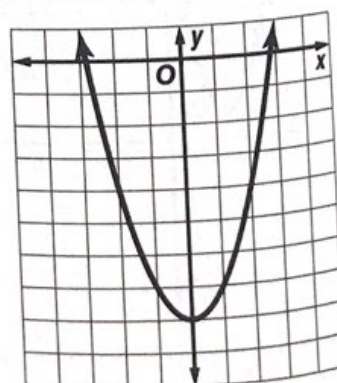
38c.

51. $x = 0; (0, 0); \min$ 52. $x = 0; (0, -5); \max$ 53. $x = 2; (2, -3); \max$ 54. $x = 3; (3, -17); \min$ 55. $x = -\frac{1}{3}; (-\frac{1}{3}, \frac{2}{3}); \min$ 56. $x = -1; (-1, 9); \max$ 

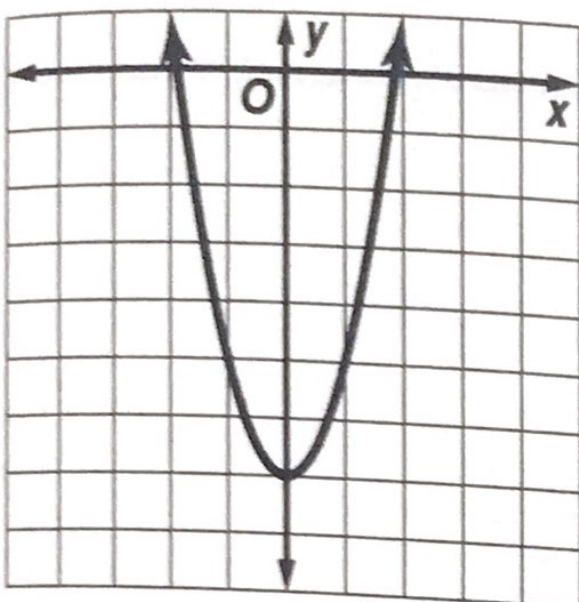
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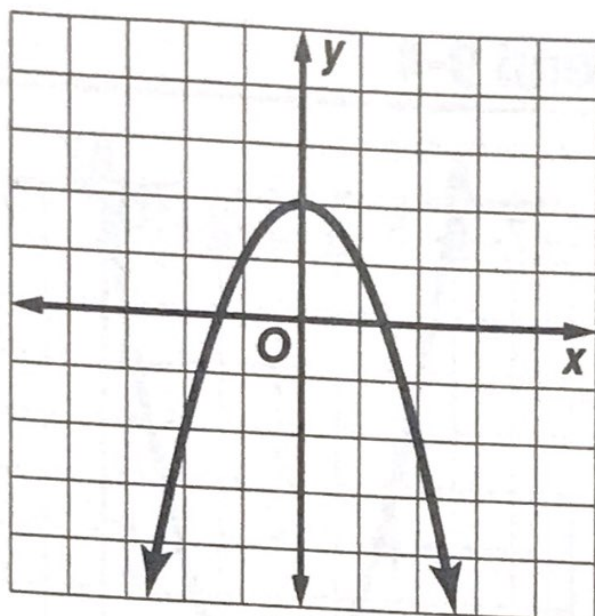
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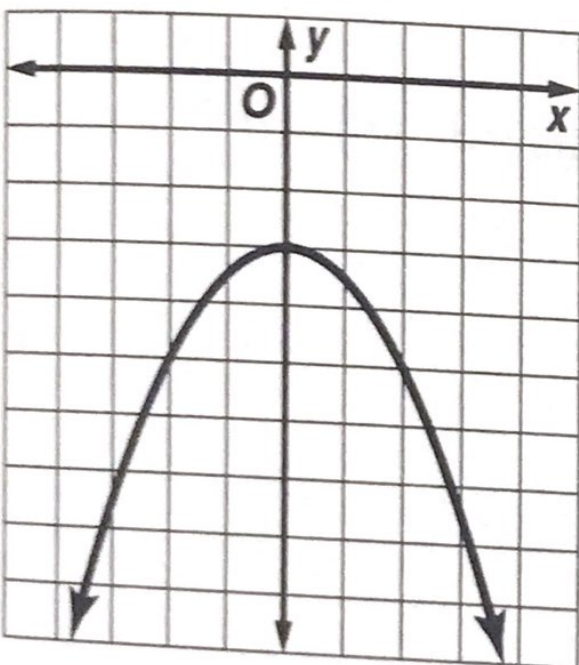
73.



74.



75.



76.

